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Anemia in Chronic Hemodialysis at the Fousseyni Daou Hospital in Kaye, Mali: Management Challenges

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Abstract

Introduction: Anaemia is one of the most common complications of Chronic Kidney Disease (CKD) and significantly impairs the quality of life of patients undergoing chronic haemodialysis. The aim of this study was to describe the clinical, therapeutic, and evolutionary aspects of anaemia in chronic haemodialysis patients at Fousseyni Daou Hospital in Kayes, Mali. **Methodology:** We conducted a prospective, descriptive cohort study lasting four months, from 1 June to 1 October 2025, at the haemodialysis centre of the Fousseyni Daou Hospital in Kayes. Patients who had been on chronic haemodialysis for at least three months and had a haemoglobin level below 11 g/dl on their blood count were included. **Results**: During the study period, 70 patients out of 117 participants were selected, including 39 women (55.7%) and 31 men (44.3%). The average age was 46.97 years ± 14.20. The average duration of haemodialysis was 21 months. The mean haemoglobin level was 7.91 g/dl ± 1.47. Twenty-seven patients (38.6%) had a haemoglobin level below 8 g/dl. The respective means for ferritin and saturation coefficient were 1044.60 ng/ml ± 477.98 and 31.10% ± 7.33%. Ferritin levels were below 500 ng/ml in 8 patients (11.4%), and the saturation coefficient was below 30% in 22 patients (31.4%). Blood transfusions were performed in 90% of patients. Intravenous iron supplemen-

tation was performed in 62 patients (88.6%). Erythropoietin (EPO) was administered occasionally in 44 patients (62.9%). Eleven patients (15.7%) received EPO at the optimal therapeutic dose (loading and maintenance dose) per week. Among the 11 patients who received optimal EPO treatment, 8 achieved a mean target haemoglobin level of 11 g/dl during the study period. **Conclusion:** Managing anaemia in haemodialysis patients in our context remains a real challenge. Optimising EPO treatment is still hampered by limiting factors, particularly economic ones. It must be integrated into a sound national policy for care provided by the competent health authorities.

Keywords

Anaemia, Chronic Haemodialysis, Kayes Hospital, Mali

1. Introduction

Anaemia is one of the most common complications of Chronic Kidney Disease (CKD) and significantly impairs the quality of life of patients undergoing chronic haemodialysis [1]. It is a major risk factor for cardiovascular morbidity and mortality in patients with chronic kidney disease, whether or not they are undergoing dialysis. The risk of mortality increases by 18% for every 1 g of haemoglobin below the lower limit of normal [2]-[4].

Anaemia in chronic haemodialysis patients must be screened for regularly. The Kidney Disease Global Outcome (KDIGO) recommendations are clear on the investigation and correction of cofactors, including iron, vitamin B12 and folate deficiencies, as well as occult bleeding, hyperparathyroidism, chronic inflammation, haemolysis, and insufficient dialysis dose [5] [6].

The prevalence of anaemia in cases of CKD increases as the estimated glomerular filtration rate decreases, reaching more than 50% in stage 4 - 5 CKD. In developed countries, data from several studies have shown a frequency of anaemia greater than 80% in stage 5 chronic kidney disease [7]-[10]. Treatment with Erythropoiesis-Stimulating Agents (ESAs) has revolutionised the management of anaemia in dialysis patients, while demonstrating its effectiveness in improving quality of life and cardiovascular function. In low-resource countries, this optimal management with Erythropoietin (EPO) is often lacking due to economic barriers [11] [12].

In Mali, we do not have enough data on the management of anaemia in haemodialysis. The hospital frequency of anaemia among haemodialysis patients at the Point G University Hospital Center in 2017 was 84.12% according to *Tounkara*, with treatment mainly consisting of blood transfusions (92%) [12].

The aim of this study was to describe the clinical, therapeutic, and evolutionary aspects of anaemia in chronic haemodialysis patients at the Fousseyni Daou Hospital in Kayes, Mali.

2. Methodology

Study type and setting: We conducted a prospective, descriptive cohort study lasting four months, from 1 June to 1 October 2025, at the haemodialysis center of the Fousseyni Daou Hospital in Kayes. Opened on 23 July 2023, it is currently the only public haemodialysis centre in the region for 2,741,000 inhabitants, representing 14.13% of Mali's population [13]. The centre was equipped with 23 haemodialysis machines using Fresenius® 4008S (Fresenius Medical Care, Germany) and Bbraun® (Germany) dialysis technology. The centre operated from Monday to Saturday and offered registered patients two haemodialysis sessions of four hours each per week.

Inclusion criteria: Patients who had been on chronic haemodialysis for at least 3 months and had a haemoglobin level below 11 g/dl on their blood count were included. Cases of haemodialysis for acute renal failure and patients who had not had a blood count and/or patients who did not give their consent were not included.

Data collection and management: The following data were collected using an individual survey form: age, gender, socio-economic status, initial kidney disease, duration of haemodialysis, knowledge and use of EPO and/or iron, knowledge of blood transfusions and their frequency. *The biological assessment requested included*: Complete Blood Count (CBC), ferritin, Transferrin Saturation Coefficient (TSC), C-Reactive Protein (CRP), folate, vitamin B12, serology for hepatitis B, hepatitis C, and human immunodeficiency virus.

The data were entered into Epidata 3.1.0 and analyzed using SPSS Version 22 and R Studio software.

The statistical test used to compare qualitative variables was Pearson's chi-square test. A p-value < 0.05 was considered statistically significant.

Operational definitions: In accordance with the Kidney Disease Outcome Quality Initiative (K-DOQI) guidelines, anaemia was defined as a haemoglobin level below 11 g/dl [14]. Severe anaemia requiring blood transfusion was defined as a haemoglobin level below 8 g/dl. Microcytosis and macrocytosis were defined as a mean corpuscular volume below 80 and above 100 fl, respectively. Hypochromia and normochromia were defined as a mean corpuscular haemoglobin below 27 and above or equal to 27 pg, respectively. Dry weight was the theoretical weight of the patient required to undergo well-tolerated dialysis sessions without cramps or hypotension. The form of EPO used was epoetin alfa 4000 IU subcutaneously. Patients receiving at least 100 IU per kilogram per week of EPO were considered to be "on regular erythropoietin", as opposed to "occasional use" attributed to all those receiving doses below 100 IU per kilogram per week. Monthly blood counts were performed on patients.

Ethical considerations: The free and informed consent of participants was obtained. Strict anonymity of the survey form was guaranteed.

3. Results

During the study period, 70 patients out of 117 participants were selected, includ-

ing 39 women (55.7%) and 31 men (44.3%). The average age of patients was 46.97 ± 14.20, ranging from 20 to 78 years. The majority of our patients had a low socio-oeconomic status, represented by housewives and labourers, accounting for 52.9% (37 cases) and 22.9% (15 cases), respectively. Uninsured patients accounted for 58 cases, or 82.9% (Table 1). The average duration of haemodialysis was 21 months. The initial nephropathy was dominated by hypertensive nephropathy (54.3%), followed by chronic glomerulonephritis (14.3%). The vascular access used was arteriovenous fistula in 45 cases (64.3%) versus 25 cases (35.7%) with central catheters. The clinical symptoms were dominated by physical asthenia and exertional dyspnoea in 32 cases (45.7%) and 15 cases (21.4%), respectively. Physical examination revealed conjunctival pallor in 27 patients (38.6%).

Table 1. Socio-demographic data.

Socio-demographic data		Staffing levels (%)
Sex	Male	31 (44.3)
	Female	39 (55.7)
Age range in years	20 - 35	16 (22.9)
	36 - 50	26 (37.1)
	51 - 65	21 (30.0)
	Over 66	7 (10.0)
Profession	Housekeepers	37 (52.9)
	Labourers/farmers	15 (21.4)
	Traders	6 (8.6)
	Others*	11 (15.7)
Health Insurance	Yes	12 (17.1)
	No	58 (82.9)

*Other professions: drivers (4), teachers (2), active civil servants (2), retired civil servants (1), students (2).

At the CBC, the average haemoglobin level was 7.91 g/dl ±1.47, with extremes of 4 and 10.8 g/dl. Severe anaemia with a haemoglobin level below 8 g/dl was found in 27 patients (38.6%). The majority of anaemia cases were normochromic normocytic, accounting for 94.3% of cases. The respective averages for ferritin levels and saturation coefficient were 1044.60 ng/ml ± 477.98 and 31.10% ± 7.33 (Table 2). Ferritin levels were below 500 ng/ml in 8 patients (11.4%), and the saturation coefficient was below 30% in 22 patients (31.4%). Folate and vitamin B12 levels were measured in 21 patients. Among them, folate deficiency was noted in 6 patients (28.6%), with no cases of vitamin B12 deficiency.

In terms of associated infectious comorbidities, hepatitis B virus was positive in 2 patients, compared with 1 case of hepatitis C virus infection and 1 case of HIV infection. C-reactive protein (N = 36) was negative (below 7 mg/l) in 10 patients

(27.8%), between 7 and 50 mg/l in 11 patients (30.6%), and above 50 mg/l in 15 patients (41.7%).

Table 2. Baseline biology of patients.

Biological parameters		Mean ± standard deviation
Haemoglobin		7.9 ± 1.47 d/dl
Ferritinemia		1044.60 ± 477 ng/ml
TSC		31.10% ± 7.33%
Folates (N = 21)		15.19 ± 9.49 ng/ml
Vitamin B12 (N = 21)		868.52 ± 407.20 pg/ml
C-reactive protein (N = 36)		38.05 ± 35.67 mg/l
		Staffing levels (%)
Haemoglobin range	Less than 8 g/dl	27 (38.6)
	8 - 10.9 g/dl	42 (60.0)
	11 - 11.5	1 (1.4)

Fifty-two patients (74.3%) were familiar with EPO and found it to be expensive. Blood transfusions were performed in 90% of patients, with a quarterly average of 4.41 bags ± 2.49 and extremes of 1 and 12 bags. Intravenous iron supplementation was performed in 62 patients (88.6%). At the same time, 6 patients received oral folic acid supplementation and 30 patients received occasional injections of vitamin C. EPO was administered occasionally in 44 patients (62.9%).

Eleven patients (15.7%) received EPO regularly at the optimal therapeutic dose per week. Fifteen patients (21.4%) had never received EPO treatment. The main reason given for not using EPO was its high cost (74.3%). Among the 11 patients who received optimal treatment (loading and maintenance doses) with EPO, 8 achieved a mean target haemoglobin level of 11 g/dl (Figure 1). The gender and age over 60 years of the patients were not associated with a statistically significant link with the severity of anaemia (Table 3). Four (4) deaths were noted, which occurred in the context of severe sepsis (2 cases) versus 2 cases of decompensation of severe anaemia.

Table 3. Distribution of patients by gender, age over 60, and severe anaemia.

		Haemoglobin below 8 g/dl		P
		Yes	No	
Sex	Male	10 (32.3%)	21 (67.7%)	0.33
	Female	17 (43.6%)	22 (56.4%)	
Over 60 years old	Yes	23 (40.4%)	34 (59.6%)	0.52
	No	4 (30.8%)	9 (69.2%)	

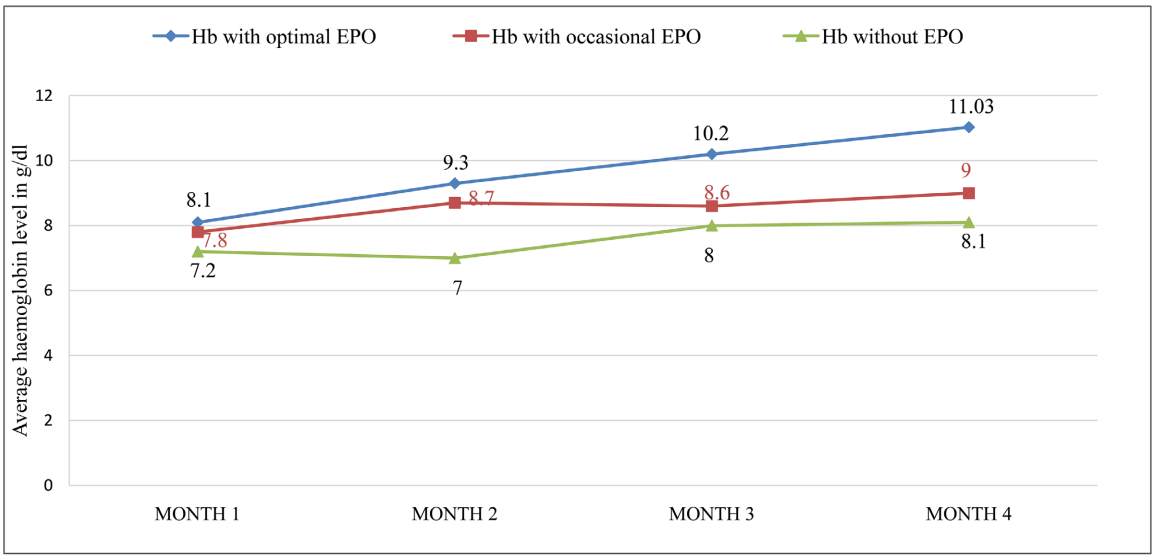

Figure 1. Change in mean haemoglobin level as a function of the EPO dose collected.

4. Discussion

During the study period, out of a total of 117 chronic dialysis patients, 72 had undergone the minimum assessment, including blood count, ferritin level, and total Transferrin Saturation Coefficient (TSC). Among them, 2 patients had haemoglobin levels above 11 g/dl, and 70 patients meeting the inclusion criteria were selected for this study. A significant number of patients did not undergo this minimum assessment due to insufficient financial resources, as the cost was estimated at $37. The majority of these patients were uninsured, with low socioeconomic status and no income-generating activity. In Mali, the state partially covers the cost of dialysis, but only for the procedure itself. It should also be noted that the costs of blood transfusions, iron infusions, and other treatments alongside dialysis were also borne by the patient.

In sub-Saharan Africa, the prevalence of anaemia among chronic haemodialysis patients was estimated to be 50.2% according to data from a systematic review study [15].

The average age of our patients was 46.97 ± 14.20 years, with an average duration of dialysis of 21 months. In 2017, *Tounkara* found an average age of 48.79 ± 11.59 years for an average duration of dialysis of 3.77 ± 2.6 years [12]. Chronic kidney disease is becoming increasingly common among young people in Mali. Hypertension, with the emergence of lifestyle changes, is a frequent cause. This is consistent with the initial hypertensive nephropathy found in the majority of our patients.

The pathophysiology of anaemia in haemodialysis is multifactorial. Common causes include relative EPO deficiency, reduced red blood cell lifespan, blood loss (repeated blood sampling, gastrointestinal, gynaecological, and haemodialysis circuit), iron deficiency, chronic inflammation, and other nutritional deficiencies (folate, vitamin B12, etc.) [5].

The majority of anaemia cases were normochromic normocytic, accounting for 94.3% of cases. *Kaze* in Cameroon found a predominance of microcytic hypochromic anaemia, largely linked to chronic infections, malnutrition, and other specific factors that were not investigated [16]. The normochromic normocytic anaemia in this study could be explained largely by a deficiency in erythropoietin rather than nutritional deficiencies.

Adequate management of anaemia remains based on the optimal use of ESAs, iron supplementation, and/or trace elements. Blood transfusion is reserved in chronic haemodialysis for certain difficult or even urgent situations (surgery, massive blood loss, resistance, or ineffectiveness of ASE treatment in cases of haemoglobinopathies and bone marrow failure) [17] [18]. In our context, it remains the first line of treatment. Blood transfusions were used in the overwhelming majority of our patients (90%). This finding has been reported in several studies conducted in sub-Saharan Africa, where patients largely do not have health insurance coverage [12] [15] [16].

Periodic administration of injectable iron was performed in 88.6% of cases, although the majority of patients had hyperferritinaemia greater than 500 ng/ml. This hyperferritinaemia appeared to be overestimated, as there were several potentially confounding factors, including multiple blood transfusions and chronic inflammation likely related to central catheters. KDIGO recommends initiating injectable iron in haemodialysis patients if ferritin levels are less than or equal to 500 ng/ml and TSC is less than or equal to 30%, and states that it is reasonable to suspend treatment if ferritin is greater than or equal to 700 ng/ml or if TSC is greater than or equal to 40% [11].

The appropriate use of ESAs remains very limited for patients in developing countries such as Mali. Today, several forms of EPO are available in the Malian capital and in certain regions where there is a haemodialysis centre. However, the only significant barrier was the price, which was beyond the reach of our dialysis patients (74.3% of cases). At the time of this study, one vial of epoetin alfa 4000 IU cost 25,000 CFA francs ≈ US$42 (excluding insurance). In the United States of America, *Gilberson* noted a smaller increase in the number of blood transfusions when patients lost their insurance coverage [18]. A decade ago in Mali, there was no national state insurance scheme that subsidized the costs of EPO. As a result, in the series reported by *Tounkara*, no patients received adequate treatment from the EPO (initial dose followed by maintenance dose), compared with 79.4% who received occasional and intermittent treatment [11]. In this study, 11 patients received adequate EPO treatment, compared to 62.9% who used it occasionally and discontinuously. This difference could be explained by the advent of AMO (Compulsory Health Insurance), to which a minority of our patients are affiliated and which covers 70% of EPO costs. The subcutaneous route was used for EPO administration. According to data from a meta-analysis, the subcutaneous route allows for a reduction in EPO doses with similar efficacy compared to the intravenous route, resulting in a 30% reduction in cost [19].

Among our patients receiving EPO at the optimal dose, eight achieved an average target haemoglobin level of 11 g/dl, all of whom were on dialysis via an arteriovenous fistula, including seven males. In 2008, in a series reported by Diallo at the Point G University Hospital, 16 out of 48 patients received EPO at a therapeutic dose of 8000 IU per week. Among them, one patient had reached the target haemoglobin level of 11 g/dl [20]. This difference could be explained by the high frequency of central catheter-related infections (93.7%) linked to the reduced availability of vascular surgeons at the time, which slowed down the creation of arteriovenous fistulas. Reports from the DOPPS study conducted in 12 countries confirm that the factors associated with a haemoglobin level above 11.5 g/dl were male gender, polycystic kidney disease, high albumin, calcium and TSC levels, and the absence of a recent catheter or bleeding [21]. The recommendations are unanimous in advising against exceeding 12 g/dl in chronic haemodialysis patients. KDIGO recommends not using ESA to deliberately increase haemoglobin above 11.5 g/dl. The French National Authority for Health (HAS) recommends reducing ESA doses if haemoglobin is above 12 g/dl and stopping them when haemoglobin is above or equal to 13 g/dl. The most restrictive recommendation is that of the Food and Drug Administration (FDA), which recommends reducing or discontinuing ESA in dialysis patients with haemoglobin levels greater than or equal to 11 g/dl [11] [22] [23]. Several other clinical trials and meta-analyses have confirmed the increased risk of overall mortality and thrombotic events when ESA treatment is continued with a haemoglobin level above 13.0 g/dl [24] [25].

With regard to other supplements, a small proportion of our patients received vitamin C and folic acid. Vitamin C is capable of mobilising iron stores in the reticuloendothelial system. Despite some positive studies, there is reluctance to use vitamin C due to the risk of secondary oxalosis. Deficiencies in dialysable water-soluble vitamins such as folic acid and vitamin B12 are well-defined causes of anaemia that must be treated, but there is no argument in favour of routine supplementation with folate and vitamin B12 [26].

This study highlighted all the issues related to the management of anaemia in chronic haemodialysis patients in the Kayes region of Mali. The limitations of this study were mainly related to the small sample size, which prevented certain in-depth statistical analyses from being carried out, but also to the disadvantaged socio-economic status of the population. Certain additional aetiological assessments, such as vitamin B12, inflammatory assessment, nutritional assessment, and gastric fibroscopy, were not explored in our patients due to insufficient financial resources.

EPO has been available in Mali for 20 years, but several prohibitive factors, particularly economic ones, hinder access to this product for our dialysis patients.

At the time of writing, treatments with Hypoxia-Inducible Prolyl Hydroxylase Inhibitors (HIF-PHIs) are the subject of major international debate due to their convincing results in the management of anaemia in chronic dialysis patients, although they are not yet available on our market [27] [28].

In our opinion, international recommendations for the management of anaemia in haemodialysis need to be re-evaluated and adapted to our African context, where socio-economic realities are different.

5. Conclusion

Treating anaemia in our context remains a real challenge. Optimising EPO treatment still faces limiting factors, particularly economic ones, given the disadvantaged socio-economic status of the majority of our patients. There is a strong case to be made for social assistance and the implementation of sound health policies for the care of chronic dialysis patients.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Appendix

Survey form:

Age: / /

Gender: / / 1 = male 2 = female

Occupation: / / 1: Housewife 2: Farmer/labourer 3: Shopkeeper 4: Civil servant 5: Other

Other occupations to be specified: _____

Initial kidney disease: / / 1: Chronic hypertensive nephropathy (NSB), 2: Malignant hypertension, 3: Chronic glomerulonephritis, 4: Chronic tubulo-interstitial nephritis, 5: Diabetic nephropathy, 6: Chronic obstructive uropathy, 7: Undetermined nephropathy.

Vascular access for haemodialysis: / / 1: Fistula 2: Central catheters.

Duration of haemodialysis in months: / /

Physical asthenia: / / 1: yes, 2: no

Exertional dyspnoea: / / 1: yes, 2: no

Conjunctival pallor / / 1: yes, 2: no

Heart murmur/ / 1: yes, 2: no

Haemoglobin: / /

Type of anaemia: / / 1: Normochromic normocytic anaemia, 2: Microcytic hypochromic anaemia, 3: Macrocytic anaemia.

Reticulocyte count: / / 1: Less than 120 G/L 2: Greater than 120 G/L.

Ferritin level in ng/ml: / /

CS in %: / /

Serum iron: / /

Folate: / /

Vitamin B12: / /

Knowledge of EPO: / / 1: yes, 2: no

EPO expensive: / / 1: yes, 2: no

EPO treatment: / / 1: occasional administration, 2: one-off administration, 3: never received.

Iron treatment: / / 1: injectable, 2: oral, 3: never received.

Vitamin C injection: / / 1: yes, 2: no.

Folate: / / 1: yes, 2: no.

Vitamin B12: / / 1: yes, 2: no.

Transfusion: / / 1: yes, 2: no, if yes, how many bags were received per year _____

Change in Hb level/month:

M1: / / M2: / / M3: / / M4:/ /

Deceased: / / 1: yes 2: no

Context of death:_____